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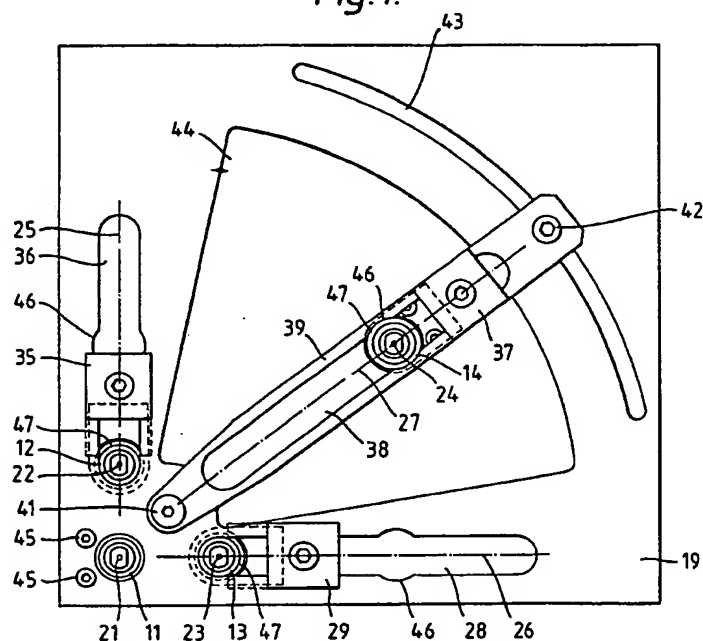
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## (54) Fastener installation apparatus

(57) A multiple head fastener (e.g. blind rivet, screw) installation apparatus comprises four rivet, etc. installation heads 11, 12, 13 and 14. The first head 11 is in a fixed position, and the second and third heads 12 and 13 are adjustable along axes 25 and 26 at right angles to each other and intersecting at the first head 11. The fourth head 14 is adjustable along an axis 27 which is also angularly adjustable in the quadrant between the axes 25 and 26 and also substantially intersects the first head 11. The adjustable heads 12, 13, 14 are secured by reversible clamps 35, 29, 37 slidable along slots 36, 28, 38, slot 38 being provided in an arm 39 pivoted at 41.

Fig. 1.



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## SPECIFICATION

### Fastener installation apparatus

- 5 The invention relates to fastener installation apparatus for installing a plurality of fasteners at positions which are adjustably predetermined in relationship to each other. For example, such fasteners may be blind rivets.
- 10 In the use of such fastener installation apparatus in factories and workshops a common requirement is to be able to install simultaneously a number of fasteners in a number of holes which have already been formed in a
- 15 workpiece such as a panel or sheet of metal. The installation apparatus will comprise a number of fastener installation heads, one for each fastener position, and the heads must be accurately positioned in relation to each other
- 20 so that the fasteners are accurately positioned in the holes in each panel. The number of panels in which fasteners must be installed in the same relative positions will depend upon the requirements of the particular job. When
- 25 each job has been finished, the fastener installation heads must then be re-positioned as quickly and as easily as possible so that the next job may be started without waste of time.
- 30 Fastener installation apparatus, in which the relative positions of the heads is adjustable, has previously been complicated and expensive to build, and slow and difficult to adjust and re-position the heads. The present invention
- 35 seeks to provide apparatus which is simple and cheap to build, and quick and easy to adjust.
- Accordingly the invention provides apparatus for installing a plurality of fasteners at positions which are adjustably predetermined in relation to each other, which apparatus comprises a plurality of fastener installation heads, and means for supporting the heads, characterised in that the means for supporting the
- 45 heads comprises in combination:
- first supporting means for supporting a first fastener installation head at a first position; second and third supporting means for respectively supporting second and third fastener installation heads, at positions which are spaced
- 50 adjustably from the first position along directions which are substantially at right angles to each other, and intersect substantially at the first position; and fourth supporting means for supporting a fourth fastener installation head at a position which is also spaced adjustably from the first position along a direction which
- 55 also substantially intersects the first position and is furthermore variable in angle between the aforesaid two directions.
- According to a further feature of the invention, the second, third and fourth supporting means is each provided by an elongated guide together with a clamp to which the fastener
- 65 installation head is fixed and which can be

- secured at a position which is adjustable along the guide. Preferably the second and third guides are provided in fixed positions, and the fourth guide is provided by an arm which is moveable as aforesaid. Preferably the first supporting means is positioned at the intersection of the second and third guides, and the movable arm is movable by being rotated about a pivot which is positioned at or adjacent to the intersection of the second and third guides. In a preferred embodiment of the invention a guide is provided as a slot in a supporting member with the fastener installation head protruding through the slot.
- 80 In a preferred embodiment of the invention, there is provided a clamp which adjustably secures the head on the slot, the clamp being positioned within the slot between the head and one end of the slot, the clamp being reversible to enable the head to be adjusted right up to both ends of the slot.

A specific embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a four-headed rivet installation apparatus, and

Figure 2 is an elevation showing one of the installation heads and its supporting slot and clamp.

The apparatus of this example is intended for installing four blind, break-stem, rivets simultaneously. A blind break-stem rivet is a well known type of fastener, comprising tubular shell having a pre-formed radially enlarged head at one end and a mandrel extending through the shell having a pulling portion protruding beyond the head end of the shell and a radially enlarged preformed head beyond the other end of the shell. The shell is inserted through suitable aligned holes in workpieces (e.g. metal sheets) to be riveted together, so that the shell head contacts the nearer face of the workpieces. The pulling portion of the stem is then gripped and pulled so that the shell is axially compressed by the stem head and deforming radially outwardly to form a blind head on the remote side of the workpieces. The pulling portion of the stem is then broken off. Tools for installing such blind rivets are well known, and are commonly hydraulically operated because of the force required to install such rivets.

Once such rivet, and tools for installing it, are commercially available in many countries under the Registered Trade Mark 'AVEX'.

The apparatus of the present example is provided with four installation heads, a first one 11, a second one 12, a third one 13 and a fourth one 14. The third head 13 is shown in side elevation in Figure 2, and comprises essentially a nosepiece 15 pointing vertically upwards and detachably secured on top of a housing 16. The nosepiece 15 contains gripping and pulling means for gripping and pulling

the pulling portion of the stem of a rivet which is inserted in the top of the nosepiece so that the shell of the rivet 17 projects upwardly from the top of the nosepiece. The housing 16 contains a hydraulic actuator for actuating the gripping and pulling means, and is powered through a hydraulic hose 18.

The apparatus of this example is constructed on a rigid square steel plate 19

which is securely supported in a horizontal plane. The first head 11 is supported at a first position 21 near one corner of the plate. The second head 12 is supported at a position 22 which is spaced adjustably from the first position 21 along a direction or axis 25. The third head 13 is supported at a position 23 which is spaced adjustably from the first position 21 along a direction or axis 26. The axes 25 and 26 are fixed with respect to the plate 19 at right angles to each other, and intersect at the first position 21, which is also thereby fixed with respect to the axes 25 and 26. The fourth rivet installation head 14 is supported at a fourth position 24 which is spaced adjustably from the first position 21 along a direction or axis 27. This axis 27 substantially intersects the first position 21 and is also adjustable in direction within the quadrant formed by the axes 25 and 26.

The means for adjustably supporting the third head 13 is shown in Figure 1 and also in Figure 2. It comprises an elongated guide, provided by a slot 28 in the plate 19 along the axis 26, together with a clamp 29. The clamp 29 comprises a lower plate 31 to which is secured the upper face of the housing 16 of the head 13, and an upper plate 32. The lower plate 31 has an upwardly projecting lug 33 which is a close sliding fit in the slot 28. The two parts of the clamp are tightened together by a bolt 34 so as to lock the clamp to the plate 19 and thereby secure the head 13 at a predetermined position along the axis 26.

The second head 12 is supported by a similar clamp 35 which is adjustable along a slot 36 along the axis 25.

The fourth head 14 is supported by a clamp 37 which is adjustable along a slot 38 in an adjustable arm 39. The arm 39 is pivoted near one end on a bolt 41, which is adjacent the first head position 21. The other end of the arm 39 is locked by means of a bolt 42 which runs in an arcuate slot 43 centered on the pivot bolt 41. The arm 39 spans a sector-shaped void 44 in the plate 19, through which the fourth head 14 passes. By adjusting the angle of the arm 39, and the position of the fourth head 14 radially along the arm, the fourth head can be supported in a wide range of positions.

The first head 11 is supported in the fixed first position 21 in which it protrudes through a fixed hole in the plate 19, where it is secured by means of two bolts 45 a bracket

which is similar to the lower plate 31 of one of the adjustable clamps.

As illustrated in Figures 1 and 2, each head 12, 13 and 14 is positioned, in its associated slot 28, 36 or 38, on that side of its associated clamp 29, 35 or 37 which is remote from the first head 11. In this arrangement, each head 12, 13 and 14 can be adjusted right up to the end of its slot which is nearest to the first head 11. However the position of the clamp presents the head being adjusted right up to the other end of its slot, since the clamp comes between the head and that end of the slot.

To overcome this limitation, each clamp can be easily be dismantled, by undoing its clamp bolt such as 34, and re-assembled reversed, i.e. turned through 180 degrees, with the head nearer to the end of the slot remote from the first head 11.

Each riveting head, when its clamp is dismantled, can be dropped downwards through its slot. However, in order to quickly remove and replace the nosepiece 15 of each head (which unscrews from the housing 16), each slot is provided with an enlargement 46, of circular shape, about mid-way between the ends of the slot. This enlargement is large enough to pass the flange 47 at the lower end of the nosepiece.

The mountings of the four riveting heads 11, 12, 13 and 14 are arranged so that the tops of the nosepieces of all four heads are level with each other, so that rivets can be installed simultaneously in a flat panel. The hydraulic hoses 18 of all four heads maybe connected together so that all four heads act simultaneously.

It will be clear that the apparatus described in this example allows quick and simple adjustment and re-positioning of the rivet installation heads with respect to each other. Usually it will be required to place four rivets at positions which are at the four corners of a rectangle. The size and shape of that rectangle is readily adjusted, over a wide range of sizes and shapes. In addition, the second, third and fourth positions can be easily adjusted, with respect to the first positions, to form a wide range of different arrangements other than a rectangle.

The invention is not restricted to the details of the foregoing example. For instance, the guides for the adjustable riveting heads 12, 13 and 14 may be provided in some form other than slots in plates. Heads for installing fasteners of other types (e.g. screws, or non-breakstem blind rivets) maybe used in the apparatus.

#### CLAIMS

1. Apparatus for installing a plurality of fasteners at positions which are adjustably predetermined in relation to each other, which apparatus comprises a plurality of fastener in-

stallation heads, and means for supporting the heads, in which the means for supporting the heads comprises in combination:

- first supporting means for supporting a first fastener installation head at a first position; second and third supporting means for respectively supporting second and third fastener installation heads, at positions which are spaced adjustably from the first position along directions which are substantially at right angles to each other, and intersect substantially at the first position; and fourth supporting means for supporting a fourth fastener installation head at a position which is also spaced adjustably from the first position along a direction which also substantially intersects the first position and is furthermore variable in angle between the aforesaid two directions.

2. Apparatus as claimed in claim 1, in which the second, third and fourth supporting means is each provided by an elongated guide together with a clamp to which the fastener installation head is fixed and which can be secured at a position which is adjustable along the guide.

3. Apparatus as claimed in claim 3, in which the second and third guides are provided in fixed positions and the fourth guide is provided by an arm which is movable as aforesaid.

4. Apparatus as claimed in claim 3, in which the first supporting means is positioned at the intersection of the second and third guides, and the movable arm is movable by being rotated about a pivot which is positioned at or adjacent to the intersection of the second and third guides.

5. Apparatus as claimed in any of claims 2, 3, and 4, in which a guide is provided as a slot in a supporting member, with the fastener installation head protruding through the slot.

6. Apparatus as claimed in claim 5, in which there is provided a clamp which adjustably secures the head in the slot, the clamp being positioned within the slot between the head and one end of the slot, the clamp being reversible to enable the head to be adjusted right up to both ends of the slot.

7. Apparatus as claimed in claim 5, in which the slot is provided with an enlargement through which the part of the head which protrudes through the slot can be removed.

8. Apparatus for installing a plurality of fasteners, substantially as hereinbefore described with reference to, and illustrated in, the accompanying drawings.